BIO-DYNAMICS

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COMPOST AND FERTILIZER ON PEAS
(A Laboratory-Greenhouse Experiment)

EHRENFRIED PFEIFFER

In this experiment, the early growth of garden peas was studied in relation to varying amounts of compost and fertilizer applied to flower pots in which the peas were sown. The purpose of the test was to demonstrate the differences in root growth, legume bacteria development, and in the initial growth of the whole plant; also to determine what amounts of compost to recommend for optimum results. Since we were using a plant belonging to the legume family, a compost with a low nitrogen content was selected.

Each group in the test consisted of 6 plants grown in 7 inch pots, 3 plants to each pot. The earth was an otherwise untreated soil of good quality with a moderately high organic matter content, not previously used for intensive cropping. The same soil was used for all groups, after being thoroughly mixed to obtain a uniform basis. Compost was mixed with the soil at the rate of 1, 2, 5, 8, 12 and 15 tons per acre. One group was treated with compost as a mulch at the rate of 17 tons per acre, another group received compost at the same rate in the planting holes just before seeding. For comparison, a 6-8-4 fertilizer was used at the rate of 500, 800 and 1000 lbs. per acre. A control group was grown in the same soil with no treatment whatever. Each pot contained 4 lbs. of soil.

The peas were sown on January 26th and growth was interrupted after 66 days. The plants were carefully removed from the pots, the earth washed away with great care so as not to break the roots. The lengths of the green plant parts were measured and they were weighed separately from the roots. The length and weight of the roots were also determined. Before weighing, the roots were air dried after all earth particles had been removed. Special consideration was given to the legume bacteria nodules. The length of the roots bearing nodules was measured, the total number of nodules was determined, then the larger nodules (more than ½ millimeter in diameter) were counted and weighed.

At the time their growth was interrupted, most of the plants had developed two blossoms, one additional bud, and had begun to set pods. The pots had been placed in a greenhouse

and all received the same amount of light and warmth. Each pot was supplied with a saucer, watering was done from underneath, each receiving the same amount of water. No "drought" condition was created.

The compost used was a rather earthy, well-rotted, biodynamically treated mixture, made from garbage and leaves (1/3), manure (1/3), and earth (1/3). It had been kept in a pit during the winter, exposed at all times to the weather. It analyzed as follows: moisture 40%; total nitrogen 0.4%; total phosphates 0.5%; total potash 0.23%; total organic matter 11.1%. In plain language, it was a low NPK compost.

The following table reports some of our findings:

Kind of Treatment	*Average Weight in gm. per Plant*	*Total Number Nodules on All Roots (6 plants)*	*Weight of All Nodules Over ½ mm. dia. in mgm*	*Lbs./Acre Applied*		
				N	*P*	*K*
1 Ton/Acre of Compost	14.4	422	450	8	10	4.6
5 Tons/Acre of Compost	16.3	790	900	40	50	23
15 Tons/Acre of Compost	16.1	696	900	120	150	69
500 Lbs/Acre of 6-8-4 Fertilizer	13.2	577	500	30	50	20
800 Lbs/Acre of 6-8-4 Fertilizer	13.0	640	730	48	80	32
1,000 Lbs/Acre of 6-8-4 Fertilizer	9.4	470	450	60	100	40
Control, Soil Not Treated ...	11.6	419	600	—	—	—

The basic soil used in the experiment analyzed: pH 6.5; organic matter 2.7%; available potash 300 lbs/acre; available calcium 1250 lbs/acre; available magnesium 10 lbs/acre; available nitrate nitrogen 22 lbs/acre; ammonia trace; available phosphates 150 lbs/acre.

Interpretation and Description of Other Findings:

The maximum growth was obtained with 5 tons of compost per acre.

The maximum number of legume bacteria nodules and the maximum weight of the nodules over ½ mm. in diameter were obtained with 5 tons of compost.

The minimum growth was obtained with 1000 lbs. of 6-8-4 fertilizer per acre.

The minimum number of nodules was produced on the control.

The minimum weight of nodules was obtained with 1000 lbs/acre of the 6-8-4 fertilizer.

Increasing amounts of NPK in the fertilizer application had a marked depressing effect upon the amount and weight of nodule development as well as upon the root growth. Less fine hair and side roots had developed with increasing amounts of NPK fertilizer.

The optimum effect of the 6-8-4 fertilizer was obtained with an application of 800 lbs. per acre.

The densest root development was observed where compost was applied as a mulch and used in the planting hole.

No depressing effect was observed with the application of increasing or even excessive amounts of compost. The optimum effect of 5 tons per acre, however, was not surpassed by applications of 15 or 17 tons per acre of the compost. The practical farmer will be able to understand, on the basis of experience, our observation that no further increase in yield can be expected after the optimum amount of compost has been applied (in the case of this experiment 5 tons/acre). However, larger applications of compost will not do any harm. In fact, more residual organic matter will be produced and the soil will benefit from the same for following crops. Of course, different optimal applications will probably be found for other crops.

Probably the most important observation made is that the smaller amounts of NPK in compost produce as good, or even better, results than the larger amounts of NPK in the fertilizer. In fact, 40 lbs/acre N, 50 lbs/acre P, and 23 lbs/acre K in compost produced a markedly better over-all effect than the optimum fertilizer application (800 lbs/acre) of 48 lbs. N, 80 lbs. P, 32 lbs. K in the 6-8-4 fertilizer group.

In the compost group, the applications of 1, 5, and 8 tons/acre of compost produced about an equal proportion between the weight of the roots and that of the green parts. With the application of 12 tons of compost per acre, a larger proportion of root weight and length than of green parts was produced. When 17 tons/acre of compost were applied, as a mulch, the root proportion was smaller than the weight of the green parts. When

the same amount of compost (17 tons/acre) was put in the planting hole, the root proportion was equal to the green parts. The use of the compost directly in the planting hole also brought about an increased development of large legume nodules (by weight, 800 mgm. as against 650 mgm.). Little difference in nodule development was observed as between applications of 8 or 12 tons per acre of the compost.

One ton of compost, with 8 lbs. of N, 10 lbs. of P and 4.6 lbs. of K, yielded as much or even better than 1000 lbs. of 6-8-4 fertilizer, with 60 lbs. N, 80 lbs. P, 40 lbs. K, and this in spite of the fact that the NPK in compost is much less "available" than in the fertilizer. The term "available" as developed in connection with the fertilizer theory does not apply to compost.

Conclusions:

On peas, 5 tons of compost per acre will produce an optimum effect if broadcast or used as a side-dressing near the plants and worked into the surface soil (upper four inches). If compost is used as a mulch, a somewhat larger amount will be needed. Compost used directly in the planting hole will increase the development of roots, which might be desirable in dry climates, in the case of heavy soils, and if seeds are sown late in the season.

BREAD MAKING — SCIENCE AND ART

EVELYN SPEIDEN

This was bread making day, always an enjoyable occasion, for although I've been making my own for many months now, there is still that anticipation of "the best loaf yet." (Weather provides some uncertainty even for the best bread makers, so they say; but I do not need its help in that regard.) And besides the pleasure of eating wholesome, fine-flavored bread, I find much satisfaction in producing a fundamental necessity.

While stirring the dough today, I fell to wondering what it would be like now after doing all the work on my small place for three years, to have someone else take over all the cooking and planning, to live like a city-dweller who dines out or like those with so much household help that they never know what the next meal will be until they sit down to it. "Wonderful, that would just suit me!" I can hear many of you saying—and not without reason. The ever-recurring urge to eat is monotonous —to say the least—from the cook's standpoint. "Twenty minutes to eat what has taken two or three or more times as long to prepare," you say. One never escapes the grim necessity of getting ready for the next meal. But every cook—and I mean *every*—should be able to shift this responsibility to other shoulders at least once a week and occasionally for longer vacations. A family would profit by such a change as well as the cook, avoiding stagnation.

Yes, although I still like cooking, I do often begrudge the time for it. With gardening, office work, interruptions of phone and guest, beekeeping, sewing, mending, laundry, trips to town and dozens of other things I long to do, it is easy to become so absorbed that stopping to prepare the next meal is a chore, simple though the meal may be. Yet I come back to the certainty that there are few abiding satisfactions in life equal to those we get from being closely connected with the basic needs and activities. Food preparation is one of these; food production is another. What keeps the farmer on the farm? He works harder and longer hours than most and for less—usually even uncertain—financial return. It is the returns of another sort that keep him going,—knowing that he is engaged in a fundamental job on which mankind depends; being able to plan his own work and make his own decisions; cooperating with nature as well as with man; adapting to endless varieties of

weather, rhythmic seasonal changes and never static natural conditions; learning to understand and live by the laws of God as well as those of man; dealing with living materials in soil, plants and animals. More or less conscious of all this, the true farmer would not be dragged away to some factory or office job paying much more money. Though he knows the importance of money well enough by long experience in its careful use, he knows also its rightful place. Many things it cannot buy.

And the housewife carries on through the next stage, making the transition from raw materials of the farm, to the product that is ready for eating. Her job is no less important, even with all modern developments. The task of guarding intelligently the quality and nutritive values in food is, in fact, infinitely more complicated than a few generations ago. And such are the thoughts that go with bread making, symbol of all that takes place between field or garden and the dinner table.

Natural wholewheat flour is pleasant to handle (the whole grain can be made sufficiently fine for any purpose),—sifting, measuring, mixing and then—the miracle that happens when liquid is added! As one stirs and stirs, the whole mass takes on a unity, a life of its own. A "being" is born that responds differently to this or that manipulation and to varying environment. One must get acquainted with this "bread being" in all its reactions in order to produce good bread—and this does not come about in a hurry. It's no use to start unless you are going to persist year after year with bread making until you learn to know all the things that can happen, how to avoid what you do not want, so as to get the one desired result. Just as with compost making, in turning raw material into neutral, colloidal humus, so here also there are definite laws for control. One may use a great variety of materials for either process but to know the fundamentals frees one from following little rules. Every possible bit of knowledge that science can provide is useful, and in addition all the artistic skill one can muster, for in both cases one deals with life activities, not just inert material.

Always on the lookout for suggestions, I've tried a number of bread recipes, but now am using the most simple, as best quality material needs less "dressing up,"—

1 *cake or package of yeast* in 3 *and* 1/3 *C. lukewarm water.*
8 *and* 2/3 *C. wholewheat flour* with 2 *t. salt.*

Mix the first two, then the second two, finally combine both

mixtures, stirring long and thoroughly. The flour I use is ground by a slow, non-heating milling process which conserves all the vitamins in the whole grain, with nothing added or taken away. The grain has been grown Bio-Dynamically in humus-conserving crop rotations for twenty some years, both here on Dr. Pfeiffer's farm and for years before in other localities, and as a result has a high content of all the essential minerals and trace elements. Among the 17 to 19 elements detected by spectrographic analysis are potassium (8,000 parts per million), phosphorus (5,800 p.p.m.), magnesium (3,200 p.p.m.), magnesium (3,200 p.p.m.), calcium (1,000 p.p.m.), sulphur (200 p.p.m.), iron (190 p.p.m.), sodium, silicon and traces of manganese (67 p.p.m.), boron (32 p.p.m.), copper (24 p.p.m.), molybdenum, zinc, silver, aluminum, barium and lead. To learn what such flour itself will do without complication by the various materials so often added to bread, is one reason why I like this simple recipe. Probably it is as near as one can get to the essential values of the primitive "staff of life" again.

The protein content of this wheat varies from 11% up, according to moist or dry growing conditions, this year's being 13.6%, although it is a soft wheat. This protein or gluten content is important because it forms the sticky, elastic cell walls in the dough which hold in the carbon dioxide gas bubbles and thus allow the bread to rise. The more a dough is stirred, the more elastic the gluten becomes and the better it holds together, making possible a lighter bread. So if you have time to let your bread rise 2 or 3 or 4 times, the texture is increasingly fine. Each time the dough doubles in bulk, press it down in the middle, fold over the sides and mix again, keeping the temperature always between 80 and 85 degrees, which suits the yeast plants best. Generally it takes about an hour for each rising, the first somewhat longer, the others progressively shorter. No kneading is necessary for wholewheat bread; in fact, some say it should never be kneaded. If you are not familiar with the new improved active dry yeast, try it. One package is equal to a yeast cake, does not require refrigeration and keeps some weeks (see date on back of package).

As for the baking, there seem to be two schools of thought. One expert bread making friend advises that after the loaves have been set in baking pans for the last rising, they should be allowed to stand only briefly, perhaps fifteen minutes, until they have just started to rise, then placed in a fairly cool oven

not yet up to the 375 degrees at which it is set. Other authorities say to let the loaves rise the last time until double in bulk again, and start in an oven pre-heated to 425 degrees so as to set them quickly before they can fall. After fifteen minutes reduce heat to 375. Theoretically I should prefer using the lower temperatures, but practically I've not yet decided which works the better. There seems to be considerable danger of the bread falling if it rises too high at the last, perhaps also if it rises too quickly in too warm a place. Sometimes these conditions, together with too little mixing, tend to make large holes in the bread, especially one large hole near the top. In any case the texture of real whole grain bread is bound to be different from what the general public is accustomed to, and the nutty, flavorful brown loaf, smelling so fragrant as it comes from an hour in the oven, will surprise you with its hunger-satisfying quality.

Wheat, with the largest percent of gluten, makes the best general bread flour, but most of my bread making friends agree that some rye flour — up to about 20% — in the mixture, improves the quality of the bread. Instead of rye, I sometimes use buckwheat flour with good results, but in somewhat smaller proportions. Of course, there are endless variations one can make based on the whole wheat loaf, but it seems to me the new bread maker will do well to stick to the simple combinations until he or she becomes expert. They take less time, for one thing, and you may form the good habit of making your own bread before you begin on the bad one of saying "I just haven't time." For many suggestions on the how and why of bread making, as well as of its unique nutritional advantages, consult Adelle Davis's "Let's Cook It Right" (Harcourt, Brace & Co., N. Y. C., $3.00) and also another little book "Cooking with Whole Grains" by Mildred Ellen Orton, published for $1.00 by the Vermont Country Store, Weston, Vermont, which is already in its second edition.

Regardless of any persuasive advertising, bread made with whole grains is far superior nutritionally to any enriched product. Not only are more values removed in the latter than are put back, but the very process of tampering with nature's balances involves complications science is only beginning to discover, such as the delicate adjustments between vitamin, mineral and trace element content. Man's bungling subtractions and additions generally take no more account of nature's equilibrium in food than in soil. Commercial manipulations of either are apt to be beneficial to the processor rather than the consuming pub-

lic — to put it mildly, and in spite of occasional good intentions on the part of the former. You can protect yourself both financially and nutritionally by making your own. However, the processor knows better than to be alarmed by such warnings. Bread making in the home does involve more work than a visit to the super market for a ready-made loaf, and until you know its superior flavor and investigate fully its vital importance for health — perhaps the only nutritional adjustment many city families can make — you are not likely to find within yourself the energy and persistent determination to make your own bread.

One thing has become clear to me in the course of bread-making experiences — the basis for the argument over yeast versus baking powder for leavening. Again it is the difference between a living process and a chemical one, and whether or not we understand the full implications of either, we are safer to stay as near as we can to the life activities in any realm. The action of baking powder, or of soda with an acid, is a chemical reaction between a base and an acid to form a salt, meanwhile liberating the gas needed to make the bread rise. Besides the possibility of undesirable chemical residues, there is the certainty that soda (and baking powder also contains soda) destroys up to a quarter of the vitamin B_1 present and harms a number of the other B vitamins. Although there are possible combinations which somewhat minimize these disadvantages, it is safer and easier to avoid soda. With yeast breads the growth of the tiny yeast plant, feeding on a small amount of the starch or sugar in the dough, produces the gas — a kind of fermentation. In the compost pile there is fermentation of another sort. There we want to produce humus. The bread making fermentation should give us alcohol and carbon dioxide gas. In neither case do we want to take chances of getting some other kind of fermentation. The necessary conditions of air, warmth and moisture must be present for each, plus the six preparations (502 to 507) for compost, or the yeast cake for bread. As one who has never had his hands in dark, friable, living soil cannot fully appreciate the concept of humus, so it takes the actual experience of handling the yeast sponge for a real comprehension of its living qualities. You are missing something in life by putting off the opportunity for this fundamental creative activity.

THE EXPERIMENTAL GARDEN OF 1950
(Summary)

EHRENFRIED PFEIFFER

Results and observations of the minerally fertilized plot versus the bio-dynamically treated plot were last presented in *BIO-DYNAMICS*, Vol. VII, No. 5. The main results noted there were: increased organic matter content in the B. D. plot, higher contents of carotene in leaves from plants grown in the B. D. plot, and considerably greater bacterial activity in the B. D. soils.

The observations made during 1950 confirm this pattern again, even though the cultivation of the soil was delayed by continued and excessive rains. It was, for instance, possible to work the soil for the first time only on the 21st of May, about four weeks later than is normal. The treatment of the soil was again on an approximately equal basis, i.e. about the same amounts of NPK in the fertilizer (6-10-4) and in the B. D. compost and manure. The B. D. mixture of compost and manure consisted of 3 parts of compost to 1 part of manure. All plots were cultivated alike.

Tomatoes, peppers, beets, carrots, corn, and bush beans were planted in each lot. The B. D. spray preparations 500 and 501 were applied to the B. D. section at the proper times. Qualitative differences in the harvested plants as far as tenderness and sweetness are concerned (corn, beets), were observed in favor of the B. D. crops. The Min. tomatoes had a thicker and tougher skin.

From the findings which follow, the reader can see the confirmed pattern, noted above, emerging in more detail.

Carotene Content in Gammas Per Gram of Leaves:

	Min.	*B.D.*
Corn	60	90
Beans	12	45
Tomato	0	5
Pepper	90	110
Carrot Root	18	20

	Min.	*B.D.*
pH of the Soil Before Cultivation Started	4.5	6.0
pH at Harvest Time: Corn plot	5.0	7.5

Bean plot	5.5	7.0
Tomato plot	5.0	7.0
Pepper plot	5.5	7.5
Carrot plot	5.5	7.5

Nitrate Content of Soil at Harvest in Lbs/Acre:

	Min.	*B.D.*
Corn	14	28
Bean	16	32
Tomato	10	15
Pepper	14	4
Carrot	4	12

Available Phosphate Content of Soil at Harvest in Lbs/Acre:

	Min.	*B.D.*
Corn	150	130
Bean	180	150
Tomato	100	100
Pepper	100	150
Carrot	100	125

Organic Matter Content of Soil	*Min.*	*B.D.*
Before Cultivation in Spring in %:	1.07	3.12

Organic Matter Content at Harvest in %:

Corn	2.5	3.3
Bean	2.6	3.7
Tomato	2.9	4.0
Pepper	3.1	4.1
Carrot	3.3	4.3

Aerobic Bacteria Counts of Soil at Harvest in Millions per Gram:

	Min.	*B.D.*
Corn	1250	1540
Bean	3600	30000
Tomato	400	1380
Pepper	575	775
Carrot	1750	2250

The nodules of nitrogen-fixing bacteria on the roots of the B. D. beans were large and plentiful; on the Min. bean roots hardly anything could be seen.

No other comment or interpretation is necessary with regard to this experiment. Acknowledgement, however, should be made to the co-workers who cared for the garden and carried out the laboratory analyses.

NOTES AND CORRESPONDENCE

"Please tell me how large a tank I would need to care for 15 to 18 animals," inquires a man who wants to save his liquid manure from the barn. Dr. Pfeiffer replied, "One cubic yard per animal per year, i.e. 18 cubic yards. If you empty it twice a year, 9 cubic yards might do." By using in the liquid manure tank the same Bio-Dynamic preparations (502 to 507) as are inserted in compost or manure piles, it is possible to ripen this liquid before spreading it, as well as to conserve all its nutrients, provided the preparations are added early. For this reason it would be better in this instance to have an 18 cubic yard tank divided in half. Then the fresh supply could be going into the second half while the full half is going through the fermentation process.

Public interest in Bio-Dynamics is very different from even a few years ago, when one had to do a lot of explaining. Now folks usually have some idea of it, though often a distorted one. And compost making! Everybody's doing it, or wants to begin. On lecture trips this spring to Asheville, N. C., and Washington, D. C., Miss Speiden found special interest in compost making demonstrations.

In Biltmore Forest a group of enthusiastic garden club members and friends gathered in a hillside garden where standing room was at such a premium that some nearly fell into the shallow pit foundation before it could be filled,—with a layer of fresh manure (horse manure preferred if you can get it), then a layer of vegetable material (garden refuse, garbage, leaves, etc.) with lime sprinkled on it as a Scotchman would sprinkle sugar on his porridge (quick or hydrated lime, not ground limestone or agricultural lime), finally a light covering of soil, the best available. All these were thin layers, as experience shows they ferment more quickly. The hose was handy to moisten each layer as the pile was built, repeating the vegetable material, lime and soil until it was about half made. With plenty of manure available, this layer could be repeated too, but it is especially good at the base, and it is *very important* to make sure no lime comes in contact with the manure, as nitrogen is thus liberated and wasted. In a finished pile the six Bio-Dynamic preparations are inserted in six scattered holes, but it is easier to lay them on a half finished pile provided there is plenty of

additional material to cover them well and at once so they will not get dry. The latter was done in this case, the five dry teaspoonsful laid in separated spots, the liquid stirred in a gallon of water and poured half on the sixth spot, half sprinkled around the edge as an attractive invitation to earthworms. Then a few more layers were added before the pile was left to be completed as material accumulated. When it was all built, a *thin* skin of earth was to cover the whole. This helps conserve moisture in the pile (therefore it should not be caked or allowed to grow vegetation) but must not be thick enough to shut out air. Some in the audience that day have since made their own piles.

In Washington another group, homoeopathic laymen interested in good nutrition as well as in gardens, received their first impressions of Bio-Dynamic practice from a similar demonstration. There, in Dr. Green's garden, were generous amounts of leaves, grass cuttings, garden refuse and even garbage, grouped neatly around awaiting the occasion. The gardener there has made these piles before, so he and a special assistant gave efficient help, the neighbors trooped in and it turned out to be quite a festival. Some of these folks too, are now going ahead enthusiastically with their own piles. It is encouraging to find an increasing number of people eager to *do something* about their interest in good soil, good vegetables and fruit, and good health.

From our friends, the Philbricks in Missouri, came a note in January, "Every time we try a B. D. spray we kick ourselves for not having tried it long before. Sunday we used 501 on the plants in the greenhouse and at home. On Monday we both thought the plants looked more alive, but discounted that fifty percent to allow for enthusiasm. Today, Wednesday, the plants show definite response in the form of new leaves in the center of most of the annuals and new leaf buds on the begonias. Of course, you people who have always known how good the sprays are, won't be a bit surprised, but we are, and pleased too."

In May came more bits of interest: "Another thing we do want to mention is the great improvement in the condition of the soil this spring over what it was last spring. (They are speaking of the soil in their garden.) We used B. D. compost last summer and sprayed with 500 last spring, and twice already this spring. This soil in its untreated state tends to make 'mud balls' if it is worked when it is too wet. Then the sun comes out and bakes the mud balls. Nothing will break them up. Standing

on them does not crush them. A sharp blow with the edge of a trowel may cut through the ball, but it falls apart in two halves which stay intact, as hard as ever.

"Now, however, we find that we can walk on the garden within an hour and a half after the rain stops. We do not then pick up great gobs of mud on our feet. Half a day later, the soil is crumbly enough to work. The lumps fall apart and no longer form 'mud balls'. This year we have worked some parts of the garden we had not got to last year, and the difference is very noticeable.

"Our garden is 90 by 90 feet. Last year and this we have spent less than $20.00 for seeds and tools. Our set of tools include a wheel hoe (*used for a plow this year because the soil was not too hard to turn*), scuffle hoes, criles, rake, shovel, wide trowel, narrow trowel. Compost was made from material begged and hauled from several different barn floors and loafing pens, and from garbage hauled from the Institute kitchen.

"We feel that the time spent in stirring the preparations is more than offset by the ease with which we can get the garden work done. (Both of us are working full time on other jobs.)"

From Mrs. M. C. in Troy Center, Wisconsin, comes a suggestion, "We have in moving now and again encountered the remains of an old orchard, a few straggly trees with small wormy fruit. Our first step is to fence them in and as soon as possible to turn in about twenty-five chickens to the acre. Even if the soil is never worked there will be an amazing difference in the fruit, especially if a small coop can be built so that a few are kept all winter and turned out very early in spring (no poison spray, of course). We have an acquaintance with a two acre cherry orchard who never has to spray, and besides cherries in the spring, he has a few chickens to use or sell in the fall.

"This might be worth trying—plant petunias among potatoes to keep bugs off. It is said they eat the petunias and let the potatoes alone."

NEWS FROM CALIFORNIA (& B. D. VIEWS)

BARBARA BETTERIDGE

If we keep our sights pointed skyward these days, we are often able to bring down Dr. Pfeiffer for a brief visit, as he commutes between New York and his work as consultant for the new compost plant in Oakland. Although advance planning would be more effective, still it is always possible to find an eager audience for Dr. Pfeiffer here, even on short notice.

As a starting point, we have in California considerable awareness of the nutritional inadequacies of the ordinary diet, and a growing conviction that organic agriculture is an important part of the answer. Every town has its health food stores, selling natural grains, unsulphured fruits, herb teas, yogurt, blackstrap molasses, and countless vitamin pills. Here and there, organically grown fruits and fresh vegetables are beginning to be available too.

So far, the chief interest in organiculture in general or in the Bio-Dynamic method in particular is among consumers, or at best back-yard gardeners, but perhaps that is a preliminary step toward enlisting growers.

One of the most encouraging developments is the active interest in Dr. Pfeiffer's work shown by the American Academy of Applied Nutrition, a group formed largely of medical men, especially dentists, and others who are seriously concerned over the deterioration in the quality of foodstuffs as it is reflected in health. Dr. Pfeiffer has addressed several of the southern California chapters of this society in recent months, and in April he was a featured speaker at their national convention held near San Diego and attended by several hundred members.

But it has to be admitted that outside of such scientific groups there is often more fervor than exact knowledge involved in some of the efforts to improve the food situation. For this reason it is especially desirable to give the public an opportunity to listen to Dr. Pfeiffer, who speaks from long experience and careful observation in the field and in the laboratory, and who therefore can save the experimenters with organiculture from some of the errors of inexperience.

The lack of a bio-dynamic demonstration farm here is our greatest drawback. It is hard to prove in *words*, even in Dr.Pfeiffer's telling words, the real advantages of the Bio-Dynamic method. Of course strict proof of any agricultural method rests

upon improved health of men and animals and upon seed quality —by no means easy matters to demonstrate. Short of that, however, seeing and tasting differences in quality speak to most people more convincingly than laboratory analyses, and it is this opportunity we lack here. Meanwhile, the few of us who have actually eaten products grown according to the bio-dynamic method feel that we have seen and tasted proof enough that this method is worthy of our support. Vegetables grown in sewage sludge, on the other hand, or with half-rotted composts and manures, appeal to us as a very poor second choice. —So, we will go on working according to our modest possibilities until we see the Bio-Dynamic method really established and taking the place it deserves in modern life.

AGRICULTURAL CONFERENCE

The annual argicultural conference of the Bio-Dynamic Farming and Gardening Association, Inc., will be held at Threefold Farm, Spring Valley, N. Y., August 30th-September 2nd inclusive. Readers interested in learning more about Bio-Dynamics in practical terms, are welcome whether or not they are members of the Association. It is possible to attend the sessions and commute by car from New York City. For rates and reservations at Threefold Farm, write to Mrs. Elizabeth Kroth.

REPORT ON AIRLIE FARM

R. C. SCHON

INTRODUCTORY

I was asked by the editors of this quarterly to give a report on what we have been doing on Airlie Farm for the last four years, and I am doing this with the understanding that I shall speak my mind freely without feeling compelled to paint a rosy picture on how everything becomes fine in the best of possible worlds as soon as the first 10 tons to the acre of bio-dynamic compost cover the ugly, mineralized soil our thoughtless predecessors have left us to till. Also I take for granted that everyone interested in agriculture knows the basic facts of how soil fertility can and should be furthered and preserved and I wish to help destroy the illusions of amateurs who keep on sentimentalizing about farming as a Way of Life, a "Weltanschauung," just because they find farms such romantic places to go out to on sunny Spring and Fall weekends, or who carry on a perennial flirtation with the possibility of a "country home of their own, two acres of land and a few chickens (dear little feathered friends . . . .)" without ever coming to grips with reality. Furthermore I would advocate that we bio-dynamic farmers and gardeners drop the chip we carry on our shoulder with regard to the efforts and results of academic agriculture just because we have read a few books by Pfeiffer, but start reading agricultural literature at large. This does not mean that I advocate indiscriminate reading, but if someone wishes to keep himself informed on, say, grassland farming, he should become conversant with the works of R. G. Stapledon, R. H. Elliot and the morphology of the plants he will have to deal with.

I fully agree with Mr. Louis Bromfield who, in his book, "Out of the Earth," says that the great fallacy that "everybody can farm" has done untold harm to this Continent's agriculture. I cannot think of any human activity that requires more intelligence, general instruction, manual dexterity and vital energy than the successful operation of a diversified agricultural enterprise.

THE PROBLEMS

The problems of operating this 300 acre farm 30 miles NW of Montreal are manifold and I will briefly describe how we attempt to solve them.

Silviculture

Its 120 acres of first growth timber have been this farm's main source of income. Lumber prices have steadily increased over the last 10 years and our operational costs have been in keeping, if not below, the average of the industry. But a 120 acre woodlot will at best produce 20,000 foot board measure per year on a sustained yield basis, while our yearly cut has been 5 to 6 times that quantity. According to their temperaments the various conservationists will stroke their chin, wag their finger, cluck their tongue, grit their teeth or lapse into profane language to express their disapproval, indignation or disgust with such practices by a member of the Bio-Dynamic Association. But though my head be bloody it is unbowed and I have a pretty sound explanation to offer as to why we had to do this.

Firstly, our predecessors had never touched these 120 acres of forest and the result was a heavily overstocked stand, which had to be cut selectively so as to alleviate crowding and to give the young trees a chance to develop properly.

Secondly, our hardwoods are no more exempt from the die-back disease than any trees in the north-east of this Continent. Cause and therapy of this disease remain unknown. I consider it a metabolic derangement between the soil and the tree: Excessive clearcutting of forest over wide areas has, of necessity, changed the water household and the structure of the soils, even in parts not immediately adjacent to clearcut areas. I look upon the symptom of the dying of the tree from the tip of its branches inward and downward as secondary to the preceding death of its peripheral hair-rootlets in a waterlogged, suffocating and toxic soil.

Be that as it may, so long as there is no cure for die-back, we are confronted with a choice of either losing our hardwood trees through rapid rotting on the stump, or of cutting them down as soon as the first symptoms appear.

Our softwood situation is equally problematic: As in field crops, there exists in forestry a natural rotary sequence of species, only it spreads over several decades. It so happens that in our case the valuable pine and spruce species are on the decline, i.e. they do not regenerate spontaneously, except in clear cuttings, and the less valuable hemlock and balsam are in the ascent. Unless we get out all our white pine within the next few years, we are going to lose it through heart rot and pine rust.

In connection with the waterlogged soil situation it is interesting to note that not only the softwood regeneration tends towards species resistant to poor drainage, but the same can be observed in the hardwoods, where silver birch, paper birch, hard maple, ash and white beech are slowly replaced by elm, soft maple, gray beech, and oak. Even though the latter species seem more adapted to poorly drained soils, they are subject to other specific blights, such as Dutch elm disease, and furthermore even in them I saw symptoms very similar to die-back.

I hope to have shown that we cannot escape the general decline in fertility in spite of our efforts for sound woodlot management practices, such as selective cutting, thinning, elimination of weed trees, slash removal, etc. We are part and parcel of our surroundings, have to be realistic about the dangers of our civilization and face them courageously. In our case it means that we cannot maintain the present high level of income from our woodlot. It will taper off into a sustained yield bracket in keeping with the productive capacity of our region. Poor forestry and farming practices have greatly reduced the latter; hence our yields will be dragged down in spite of our efforts to do things right.

Agriculture

To make up for this impending decline we have to look to our arable land and make it produce more. But here again we are up against an aggravating variety of problems, all connected with a general decline of agriculture and topped off with our home-spun varieties of misery.

Firstly, there is our Canadian climate. "Bracing" is the affectionate term given our winters by those whom it pays to speak of them in glowing verbiage and who hence can afford to spend their winters in warmer climates. "Give this hunk of land back to the Eskimos," is the common opinion of the man in the street, especially from January 1st to April 30th. It takes little imagination to understand the misery of a long, cold, windy, sunless Winter and a Spring that cannot make up its mind. But what heaps insult on injury is that June 10th is the latest frost-free limit and August 20th the beginning of the new frost season. This leaves only 70 days of frost-free growing season.

Secondly, our soils show the typical podsol structure: stratified sand with a high iron content over a layer of tough blue clay, the whole interstrewn with granite boulders. The layer-forming tendency is so marked in the sand that we run into hardpans in

nearly every field. The result is that as soon as a root of a field crop plant strikes the hardpan it is poisoned. The plant is at best stunted, or dies. Even now, after 9 years of attempts to overcome the toxic effects of these cold, humic acid layers we still run into many complete crop failures. Subsoiling and dynamiting have shown encouraging results but this is an expensive and slow process.

Third, not only is it hard to produce crops under these circumstances, but what increases our feeling of frustration is the extreme difficulty of marketing them. Last year was most heartbreaking. At the end of April I fell over with my tractor and broke my leg. I was flat on my back in a cast for 3 months. Besides, we ran into a bearish market for all vegetables from beginning to end. The reason for this was the lifting of import restrictions for U. S. products coupled with the complete disorganization of the market gardeners in the Montreal area. The four large grocery chains dictated the prices which were ruinous. E.g. crates of 36 heads of lettuce were offered for 30c with no buyers. Efforts to better this situation were often made, but they all failed and bogged down in a morass of petty politics.

Fourth, the problem of help on this continent is so universally difficult that it needs not much elaboration. In our case it is not one of price and quantity but one of quality.

SOLUTIONS

There seem two ways open to keep this farm going:

Subsistence farming, which is not exactly my cup of tea, so long as atomic warfare has not yet flattened our towns. But it seems to be that of our Austrian helpers.

Meat production, mainly hogs raised from our own sows and some seasonal fattening beef, imported from the West in Spring and re-sold in January. We cannot hope ever to raise all the feed for these animals, even though hogs, especially brood sows, do just as well on grass silage with whole grain blown in (Bromfield). But we can devise and make our own feed mixtures in our grain mill and save considerably by it.

Whether or not we will continue to operate Airlie Farm depends largely on the possibility of finding an experienced field husbandman who will take over on a leasehold basis. This would free me to continue in my efforts to create an organic fertilizer industry in Canada, in close co-operation with Dr. E. Pfeiffer and the California Group. I have, during the last years, done quite a few composting experiments, especially with forest

wastes and in conjunction with the Canadian Pulp and Paper Research Institute, and the prospects of interesting these industries are quite good. If I succeed, this will benefit Airlie Farm very directly.

ANOTHER EXPERIENCE REPORT

MRS. FREDERICK J. SUHR

After the comments of our esteemed contributor, Mr. Schon, in prefacing his valuable report on Airlie Farm, the editors ought perhaps to shiver at printing the following. But one of them had had the pleasure of taking part in visits to Mr. and Mrs. Suhr's farm on the Eastern Shore of Maryland at the time it was in operation, and recalls that things were going extremely well there. The author, and the editors, would be the first to admit that 2 years is too short a time for any scientific test, and weather factors and probably a certain amount of just plain luck played in. (The farm was sold after a short tenure because of the death of one of the owners).

But observations remain observations, and when we unexpectedly ran into Mrs. Suhr on a trip to New York City recently and she was recalling the farm, we said, "Do, please, write this up for a few paragraphs in Bio-Dynamics." She obliged, and here it is:

* * *

Sorry this is so delayed. It's hardly worth waiting for.

When we bought the farm it had been neglected for several years. Though you probably don't remember, you went over each field and found one or two that couldn't be used for growing that first year.

So it was all the more amazing to get such fine results at the end of one year. In the fields we could use we planted tomatoes, corn, asparagus and wheat.

Our farmer was amazed that there were no cutworms on the tomatoes. They were just beautiful. Our success with corn was considered phenomenal. Many farmers 'round about came to see it.

The apple orchard was in bad shape and in 1939 all the apples were very wormy. By the fall of 1941 we

had beautiful apples. So many not-wormy, and firm. We sold some and gave away many bushels.

Our garden (planned by Miss Speiden) of vegetables—with melons, strawberries etc.—was a great success also.

All of this marvelous success was due to our religiously following all directions and formulas. My husband had never known anything about Bio-Dynamics until after we bought the farm.

It was a real job "selling" the idea to our farmer. I remember one occasion when he told my husband that he'd written the Department of Agriculture and could get no information re Bio-Dynamics. In spite of the skeptics we stuck to it.

I wish I could tell you more but we had it such a short time. I sold it in 1941—just two years in our possession.

WHY CONTINUE PAYING FOR THE CELLOPHANE?

From THE COUNTRY GENTLEMAN, Vol. CXXI, No. 5, May, 1951

A healthy sign to us is found in a few paragraphs in the *NATIONWIDE ROUNDUP* concerning the marketing problems of farmers. The consumer who demands small, fancy packages, containing things which can be prepared in a jiffy, really pays for the packaging. The amount the farmer receives for his product is not increased. In the words of a Farm Bureau Advisory Council in Ohio: "We are producing abundantly, but our marketing seems to be sadly in need of revision. There is too much difference in what the farmer receives and what the consumer pays, which results in ill feeling between the two groups."

If this growing awareness among the producers of our foodstuffs joins with the awareness of the consumers, then, perhaps, we can more easily move toward a day when what is in the package will mean more than what it is wrapped in.

A VINEYARD IN THE MISSOURI HILLS

R. A. ARNDT

In sending Miss Speiden her interesting observations on grapes, Mrs. Karl J. Arndt of Hillsboro, Mo., commented too modestly that "I do not presume to be working bio-dynamically yet, so my observations do not carry the necessary weight." The editors are grateful that Miss Speiden, familiar to readers as B. D. Association Secretary, sent the material along for the quarterly. Observations carry the most weight when they do not stem from any pro or con attitude, but are just observations. We hope more readers will send us more and more of them.

* * *

When I took over my neglected farm in our beautiful Sandy Valley two years ago, my vineyard was badly infested with brown rot, so that the former owner was ready to chop the vines down —the fate of most home vineyards in the locality. After spraying several times with equisetum (B. D. prep. No. 508.—Ed.) during a particularly moist, muggy Summer, I observed that this disease has almost vanished, and my vines bore large bunches of grapes, perfect in bloom and aroma.

My approach was, of course, one-sided and incorrect. This year they will be carefully pruned, sprayed with 500 and 501, and equisetum. And they will be mulched variously: with creek sand for the vigorous canes, pig-manure compost for the weak ones, compost and alfalfa hay mulch for most of them. I think it would be best to mulch with sand around the vines to concentrate the sun for a sweet grape, and to mulch or seed soy beans between the rows.

A LITTLE REPORT ON CHINA FARMS

TZE-KONG WAUNG

This gentleman is, at the time of writing, engaged in trying out the organic growing of Chinese vegetables under our (lower N. Y. State) local conditions. As part of this program, he is observing the effects of B. D. composts and sprays on certain of the plantings. We asked him why he appeared to be un-interested in chemical fertilizers for his gardens. His comments were factual, so we asked him to write them down for this quarterly..

* * *

China is an old rural country out in Far Eastern Asia. The economic security of her people depends entirely on farming receipts throughout the country, and will in the years to come as it has in the past. Although in recent years industry has come sparingly into existence, it is considered to be undoubtedly of minor importance as far as China's national economy is concerned. Therefore most of the farmers look upon their farmlands as their most valuable treasuries, and are confident of being able to continue to support their families from them.

But balancing this view of the soil as the country's chief source of income is a tendency of China's culture which influences the whole picture of her farm acreage and has kept it from exhaustion for generations. There is observed in practice the principle that whatever one inherits from his father, on the latter's passing, should be prosperously preserved at least, if it is not possible to add something to it to honor him. The aim is that the same property can pass on to succeeding generations without fail. In pursuit of the achievement of honoring their ancestors, the people persuade themselves to follow the steps that have done marvelously for their forefathers and which will in turn help them. This is the factor, or belief, which leads to the continuation of primitive methods of farming that are, in reality, the organic composting farm such as many people are longing for nowadays. Obviously, it is the organic composting that helps, unconsciously, China's safeguarding of her farmlands from the destruction of chemical fertilizers.

At one time chemical fertilizer has been demonstrated vigorously, by importers, in China. But, the farmers turned it down soon upon learning the fact that while chemical fertilizer helps quantitatively on the one hand, this could never compensate for the exhaustion of soil fertility that had, on the other hand, occur-

red. Besides, it is the enemy to clay loams around the Yangtze Valley, famous as the rice barn of China.

After using it on clay farms for a term of times, it was observed that the clay loam in rice fields loses its original consistency alarmingly and continuously, turning into a sandy soil which is absolutely harmful in rice production.

But those who are growing tobacco leaves and sugar cane are still the victims of chemical fertilizer, because it is impossible for them to find a suitable substitute for it. The resultant cries for a yearly increase of chemical fertilizer have come to such a bursting point that the Chinese National Government on Formosa has been confronted by a hard situation without a profitable resolution. Since every bit of chemical fertilizer consumed on Formosa sugar cane plantations is imported, the flow of American Dollars that the Government could accumulate from exports is passing endlessly into the pot of the chemical fertilizer importations. Simultaneously, this process also weakens the life of the Chinese National Government.

However, it is delightful to learn that Dr. Pfeiffer's machine composting has been successfully operating in California. And one hopes that, some day, his success will be introduced into Formosa, thus relieving the burdens of the people there and putting an end to the drains caused by chemical fertilizer.

RESIDUES OF COPPER SPRAYS FOUND TO STIMULATE GROWTH OF SOME CROPS

From THE NEW YORK HERALD TRIBUNE, Sunday, April 15, 1951

Scientists at Battelle Institute, Columbus, Ohio, after long and careful research have discovered that a number of garden and field crops respond to the addition of a small amount of copper to the soil. These men are careful to point out that large amounts of this same element have toxic effects and to caution the amateur experimenter to use them very sparingly. All of this is described and noted in this article. But then the writer of the report concludes that gardens in which copper sprays are used will receive sufficient copper from the residues left in the soil. This is undoubtedly true, but it occurs to us (Ed. — B. D.) that continued spraying with copper year after year could build up residues that would in a short time be toxic in their effect.

A safer method of application is undoubtedly to be found by introducing it with compost, if your soil is really deficient in this trace element. Indeed, the safest and most efficient way to bring all the trace minerals to your soil and plants lies along the biological path. Many of the wild plants we think of as weeds have been found to contain surprisingly large amounts of the various trace minerals. Add such weeds to the compost heap as a part of the mixture of organic wastes being composted, the bacteria in the heap will digest and work them into the form which is readily assimilated by the plants and the dangers of 'over-dosing' will be avoided.

RORTY ON NUTRITION, POINT 4, AND COMPOST HEAPS

FRED HECKEL

James Rorty spoke recently in Spring Valley, N. Y., at the quarterly meeting of the Rockland County Conservation Association, Inc. Many readers will be familiar with his amusing and rather pertinent observations on Rudolf Steiner's contributions to agriculture, in the book "Tomorrow's Food," which he wrote some years ago in collaboration with Dr. Henry I. Norman. His topic in Rockland was "Conservation Through the United Nations" and he touched on a variety of things.

He had recently returned from a visit to Mexico and Central America, and one of the most interesting parts of his talk concerned the survey of the nutritional values of the food plants of Mexico and 5 Central American Republics completed a short while ago by Dr. Robert S. Harris, head of the Nutrition and Bio-Chemistry Laboratory of the Massachusetts Institute of Technology. The work was done under the auspices of the Kellogg Foundation, and utilized new quick-freezing techniques by means of which the various plants arrived in top condition at the Massachusetts laboratory for testing. Besides providing health workers with up-to-date nutritional tables, the survey, Mr. Rorty said, "came up with a half a dozen new plants," hitherto unused foods that will further help to improve dietary standards in the countries concerned.

"Today," Mr. Rorty said by way of illustration, "school lunches in Mexico City can be prepared from local foods which are twice as nutritious as foods in the United States that cost 5 times as much. So we have really a five-fold gain, just through the systematic application of science and technology. And it should be noted that our own food tables need re-doing."

One of your editors, remembering the lack of attention to organics in any part of the U. N. Conservation Conference program at Lake Success a couple of Summers ago — though it was frequently coming in through the back door at the instance of representatives of the under-developed countries — asked Mr. Rorty after the meeting:

"Are the Point 4 representatives of this country, and the U. N. Conservation people, working at all in terms of organics as well as chemical fertilizer?"

"They've got to," he replied. "Organic fertilizer is all that a lot of the people living in those Southern countries have to

work with. I say this, not from the complete faith in organics that *organics people* have, but considering organics as a part of the whole picture.

"Some of the best compost heaps I ever saw were at Zamarano in Hondures, at Dr. Popenoe's Esquela Agricola Americana."

THE WHOLE VERSUS THE PARTS

From *Soil Fertility, Renewal and Preservation*
By Ehrenfried Pfeiffer
Published in London, England, in 1947, by Faber and Faber Limited

Readers of this Quarterly inevitably encounter Dr. Pfeiffer in bits and pieces, chiefly in his reports of current laboratory findings and field tests and observations. For new readers, the following few paragraphs may be particularly relevant. They are the ones that open the final chapter of a book originally published as "Bio-Dynamic Farming and Gardening," and which continues to make its influence felt in many lands. That the quotation is addressed, in the first place, to Europeans, does not make it less relevant for us:

"European agriculture is on the verge of surrendering its traditional methods and of abandoning the conscious carrying on and the working and directing of its farms. Yet the European still has 'solid ground' under his feet which permits of an almost biologically balanced agriculture and in this lies his chance of a hopeful future. It is true that in Europe the biological possibilities of the land have already been overstepped, but this has happened in a fashion which still permits of a turning back and a renewal.

"Europe as a middle region between Orient and Occident represents a sort of centre of gravity in the previously described tendencies of the Far East and the Far West. Here life conditions exist out of which a new building up of a natural basis for food supply can be developed. Here, in a healthy way, methods might be devised and biological laws recognized which would be beneficial to the people of Europe, indeed, to the whole West, as well as to the diseased conditions of the earth's organism in the Orient. Here outer nature extends, so to speak, a helping hand.

"However—and here we come to a point which will perhaps appear surprising to many—the solution does not depend on nature, but on the human being. The solution of the agricultural crisis of the present time is a human spiritual problem. It consists in man's extending his knowledge of nature's being, of life's laws, and in the *creation of a method of thought founded on the principle of an Organic Whole.*

"If once the foundations of traditional culture are lost—a process which is becoming more evident in all spheres of life as the fundamental trend of the twentieth century—then no turning hither or thither, no probing, no clever thinking things out, discovering and applying, will help. All study and all that we may do remain mere patchwork, *as long as the great task, the creating of a new culture, is ignored, is not recognized.*

"If the new work we do is not to be the mere appending of the thousand and second case to the thousand and first, but rather the means of gathering and presenting a body of knowledge imbued with life and the capacity to develop, then a way can be found out of our difficulties. If we provide some one particular foodstuff, grow a specific plant variety of grain, indeed, if we do something which in its details fills our day as an agriculturist, it will all remain patchwork if these efforts are not based on a fundamentally different attitude, on our part, to the problems of life and growth—*an attitude which allows us to perceive life and growth as an organic whole over the entire earth.*

"Someone will object that this is all very well, but has nothing whatever to do with agriculture as such. The answer is that the one-sidedness of the prevailing points of view about life, nature, and the universe has been one of the chief reasons for the collapse of our culture, as the events of our times themselves fully demonstrate. . . . . ."

The chapter is entitled "Man's Responsibility," and the author goes on with specific steps to be taken by those concerned with bringing an individual farm back to health. But the book is available, under one or the other title. It still constitutes essential reading for any who are interested in the Science of Organics.

RECEIVED FROM THE PUBLISHERS

INTRODUCTION TO AGRICULTURAL CHEMISTRY by R. Adams Dutcher, Clifford O. Jensen and Paul M. Althouse. Published 1951 by John Wiley & Sons, Inc., New York and Chapman & Hall, Limited, London. $6.00.

This new and revised edition gives a comprehensive survey of what has become a highly technical field.

ADVERTIZERS WELCOMED

This quarterly has, in the past, accepted advertizing that was not out of line with its basic aims. That policy continues, with this addition: We will not only accept, but extend a most hearty welcome to such advertizing. Printing costs have gone up. We are proud to state that circulation is increasing very nicely, but at $1 a year the dollars from new subscribers are not meeting costs. It is quite possible that subscription rates will have to be raised, but meantime more advertizing would help the situation.

Our rates, which certainly give the advertizer his money's worth, are:

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